

KIRKUK CANAL CROSSING
KIRKUK, IRAQ

SIGIR PA-05-011
MARCH 7, 2006

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Special Inspector General for Iraq Reconstruction

SIGIR PA-05-011

March 7, 2006

Kirkuk Canal Crossing, Kirkuk, Iraq

Synopsis

Introduction. The report was previously provided on a limited distribution basis only in Iraq to representatives of the Gulf Region Division of the U.S. Army Corps of Engineers and the Project and Contracting Office. In accordance with the revised policy of the Office of the Special Inspector General for Iraq Reconstruction, all project assessment reports are being issued publicly.

This project assessment was initiated as part of our continuing assessments of selected sector reconstruction activities for electricity, oil, and public works and water. The overall objectives were to determine whether selected sector reconstruction contractors complied with the terms of their contracts or task orders and to evaluate the effectiveness of the monitoring and controls exercised by administrative quality assurance and contract officers. This project assessment was conducted in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency. The assessment team included an engineer and an auditor.

Project Assessment Objectives. The objective of this project assessment was to provide real-time relief and reconstruction project information to interested parties in order to enable appropriate action, when warranted. Specifically, we determined whether:

1. Project results were consistent with original objectives;
2. Project components were adequately designed prior to construction or installation;
3. Construction or rehabilitation met the standards of the design;
4. Contractor's Quality Control plan and the U.S. Government's Quality Assurance program were adequate; and
5. Project sustainability and operational effectiveness were addressed.

Conclusions. The assessment determined that:

1. The completed project should meet and be consistent with original task order objectives if current construction methods are continued. Contract specifications call for a 40-inch pipeline connection across the Kirkuk Irrigation Canal, which is a component of the pipeline system that transports oil from the Kirkuk oil fields to the Iraq to Turkey Pipeline and refineries. As a result, the project should effectively contribute to the repair of the Iraqi oil infrastructure and the re-establishment of continuous pipeline operations.
2. The design package was completed and approved prior to construction and appears specific enough to construct the project. As a result, the project should be constructed in accordance with the Scope of Work and significantly contribute to the Task Order's objective to repair and provide continuous pipeline operations between the Kirkuk oil fields and the Baiji Refinery and the Iraq to Turkey Pipeline.

3. The construction of the project will likely meet the standards of the design with continued active participation of the Quality Assurance and Quality Control personnel. Accordingly, the project should effectively link the existing pipelines on either side of the Kirkuk Irrigation Canal.
4. The Contractor's Quality Control plan and the U.S. Government's Quality Assurance program were adequate. If the programs are followed, project construction will likely conform to contract requirements and design specifications.
5. Sustainability and operational effectiveness were adequately addressed in this project. The U.S. Government does not plan to maintain or operate the pipeline after commissioning. The pipeline operations will be turned over to the Iraqi Ministry of Oil and the Northern Oil Company after commissioning. As-built drawings of the pipeline and manifold system, a recommended list of spare parts, and standard operating procedures will be provided to the Ministry of Oil and the Northern Oil Company upon completion.

Operational effectiveness was adequately addressed. The pipelines are a reliable and cost effective method of transporting large volumes of petroleum. While overland alternatives for transporting large volumes of petroleum include truck and rail, pipelines are very efficient when compared on a cost basis. The Kirkuk Irrigation Canal Crossing project is an important component of the pipeline system that connects the Kirkuk oil fields and the Iraq to Turkey Pipeline. The pipeline also feeds refineries where the crude oil will be processed.

Recommendations and Management Comments. We provided the results of our assessment to the appropriate Project and Contracting Office and U. S. Army Corps of Engineers officials, who concurred with our conclusions. This report does not contain any negative findings. Therefore, management comments were not required.

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Introduction

Objective of the Project Assessment

The objective of this project assessment is to provide real-time relief and reconstruction project information to interested parties in order to enable appropriate action, when warranted. Specifically, we determined whether:

1. Project results will be consistent with original objectives;
2. Project components were adequately designed prior to construction or installation;
3. Construction or rehabilitation met the standards of the design;
4. Contractor's quality control plan and the U.S. Government's quality assurance program were adequate; and
5. Sustainability and operational effectiveness were addressed.

Pre-Site Assessment Background

Contract, Task Order, and Costs

The Kirkuk Irrigation Canal (KIC) Crossing project will be completed under Contract W9126G-04-D-0002. Contract W9126G-04-D-0002 is an Indefinite Delivery Indefinite Quantity cost reimbursable award fee contract for the repair and continuity of operations of the Iraqi oil infrastructure. The estimated Not to Exceed amount is \$800 million for the life of the contract, with a guaranteed minimum of \$500,000. The contract was issued by the Project and Contracting Office (PCO) to the Parsons Iraq Joint Venture (PIJV).

Task Order (TO) 0014, dated 19 November 2004, was issued to the PIJV with a Not to Exceed amount of \$3,000,000, which included costs associated with completing the Tigris Pipeline River Crossing project and the KIC Crossing #1 project. The initial TO's scope of work (SOW) was undefined and intended to be accomplished in three phases. The first phase was to perform survey and investigative work so that a project plan and an initial cost estimate could be developed. The second phase was intended to produce the basic engineering design, and the last phase was the detailed design, construction, and commissioning of the projects.

There are currently eight modifications to the initial contract.

- Modification 01, dated 5 January 2005, increased funding to \$7,500,000.
- Modification 02, dated 25 January 2005, increased total funding to \$10,250,000.
- Modification 03, dated 22 February 2005, increased funding to \$11,450,000 and added the six horizontal directional drilling pipeline tie-in, the Riyadh Canal Crossing #2, and the Zegeton Canal Crossing #3 projects.
- Modification 04, dated 2 March 2005, reflected administrative changes to the contract. No additional funding was added at that time.

- Modification 05, dated 9 March 2005, definitized Contract Line Item Number (CLIN) 0002 and increased funding by \$987,890, which increased total funding to \$12,437,890 from \$11,450,000.
- Modification 06, dated 9 June 2005, definitized CLINs 0001, 0003, 0004, 0005, 0006, and 0007 and increased funding by \$45,717,035, which increased the total to \$58,154,925 from \$12,437,890.
- Modification 07, dated 12 July 2005, definitized CLIN 0003 as a result of negotiations and increased funding by \$4,056,757, which increased the total to \$62,211,682 from \$58,154,925.
- Modification 08, dated 12 July 2005, corrected information relating to CLIN 0004 on Modification 07. No additional funding was added at that time.

TO 0014 projects collectively include all remaining segments for the completion of the new 40-inch crude oil pipeline from the Kirkuk oil fields to the Iraq-to-Turkey Pipeline (ITP). Modification 5 definitized CLIN 0002 KIC Crossing. This assessment specifically addresses the PCO project numbered 18185, which is the KIC Crossing project, budgeted at \$2,087,890.

Project Objective

Project Scope and Status Reports (PSSR) disclosed that the general objective of TO 0014 is the restoration and enhancement of all remaining sections of the new 40-inch crude oil pipeline from the Kirkuk oil fields to the ITP. The completion of the 50 kilometers of pipeline and Tigris River Crossing is considered essential for increased production and transport of crude oil from the Kirkuk oil fields. The Kirkuk oil fields provide all crude oil for the Baiji Refinery, 40 to 45 percent of the crude oil for the Daura Refinery and the export of crude oil through the ITP. This is a critical project as it allows potential revenue of up to \$7 million per day in crude oil export.

Specifically, the objective of this project was the construction and installation of approximately 750 meters (m) of 40-inch diameter crude oil pipeline across the existing KIC concrete culvert bridge and connection to the existing pipeline. The KIC is the largest pipeline water crossing project between Kirkuk and the Tigris River.

Description of Existing Conditions (Preconstruction)

This project is located approximately 250 kilometers north of Baghdad, Iraq, near Kirkuk, Iraq. The PSSR states that Kellogg, Brown, and Root previously completed most of the 50 kilometers of pipeline between Kirkuk and Al Fatah¹. The KIC crossing project will traverse the KIC and connect to the new 40-inch pipeline on each end. All pipes, valves, and flanges were purchased previously and are being stored in various Northern Oil Company (NOC) warehouse locations or on site. Site photo 1 shows the pipes purchased by the previous contractor. A complete list of

¹Due to the various spellings for cities in Iraq, and in an effort to achieve standardization in SIGIR reports, Al Fatah and Al Fatha, as noted in project documentation will henceforth be referred to as Al Fatah.

available material allocated for the KIC Crossing is included in Appendix C of the PSSR.

The PSSR states that the 40-inch diameter with 0.433-inch wall thickness (WT) pipe is located on the east and west sides of the KIC. This pipe will be used to tie in the ball valve to the existing tie-in points on both sides of the river. The PIJV has completed an inventory and has determined that the amount is sufficient for the proposed pipeline routing.

The 40-inch diameter with 0.688-inch WT pipe will be used for the canal crossing itself, including the length required to the ball valve location. The PIJV has completed an inventory and has determined that the amount is sufficient to accommodate the proposed pipeline routing. The valves and flanges were inspected by PIJV and found to be in good condition.



Site Photo 1: Pipes Purchased By Prior Contractor

Scope of Work of the Task Order

The PSSR states that the general SOW includes the installation of approximately 150 m of 40-inch diameter with a 0.668-inch WT Grade 60X pipe in the culvert of the bridge across the KIC, and approximately 600 m of 40-inch diameter with a 0.433-inch WT Grade 60X pipe to connect the bridge section to the existing 40-inch line previously installed. The significant field activities for the project are:

- Excavation of pipeline trench
- Fabrication of pipelines

- Construction of valve pits
- Installation of pipelines and tie-ins
- Hydrotesting and commissioning

The approximate valve pit locations have been identified at the north and south ends of the bridge, subject to minor change. The subcontractor shall excavate the designated area and install two concrete valve pits at the north and south end of the Canal Crossing in accordance with the issued civil drawings.

Two 40-inch valves will be installed in the valve pits and all pipe entry and exit routes will be sealed with cement grout and mastic sealer compound to prevent water or oil seepage into the valve pits. The valve pits will have reinforced concrete sectional slabs roof cover with lifting lugs to enable NOC access. This will form an effective barrier against unwanted interference, as well as an acceptable roof structure.

There are flanges and blind flanges on both ends of the existing 40-inch pipeline. These will be removed and welded on the newly installed pipeline for the purpose of hydrotesting. Following the satisfactory hydrotest, the flanges will be removed and the final pipeline butt welds completed. The completed pipeline will be subjected to a hydrotest, as per the PIJV procedures. Upon completion of all hydrotests, water will be drained and the line blown dry using an air blower. The installed pipeline welded joints will be coated and wrapped, per the Quality Assurance (QA)/Quality Control (QC) plan.

Upon satisfactory completion and acceptance, the pipe trench will be back filled with washed river sand to a cover depth of 50 centimeters (cm) over the newly installed pipeline and will follow the project civil engineering design criteria. The final completed project will be inspected by the PIJV construction and inspection departments, and a mechanical certificate will be issued to the subcontractor upon the installation's satisfactory completion.

Current Project Design and Specifications

The contract required the submission and approval of Phase I, Phase II, and Phase III design and specifications. Phase I was to perform survey and investigative work so that a project plan and an initial cost estimate could be developed, Phase II was intended to produce the basic engineering design, and Phase III was the detailed design, construction, and commissioning of the projects.

Following is a list of the appropriate specifications that will be utilized during installation and construction of the pipelines.

- Overall Pipeline Routing Plan
- Alignment Sheets
- Pipeline Cross Section & Details
- Special Pipeline Construction Specification
- Construction, Commissioning and Hydrotest Support

- Valve Pits Plan Sections and Details
- General Pipeline Construction Specification
- General Pipeline Welding, Testing and Inspection Procedures

The general design for the KIC has been completed and drawings are included in Appendix H of the PSSR. During the course of this assessment, we reviewed detailed drawings for the KIC. The design drawings and specifications appear to be complete and consistent with the requirements of the contract.

Reported Project Work Completed and Pending

We determined the project's status prior to the site visit through discussions with the U.S. Army Corps of Engineers (USACE) Area Engineer and Design Engineer and the PIJV Project Engineer and Quality Manager, and a review of the PCO contract file.

Project site work reported completed:

- No significant work elements were completed prior to the site visit.

Project site work reported in progress:

- Excavation of pipeline trench
- Fabrication of pipelines

Project site work reported pending:

- Construction of valve pits
- Installation of pipelines and tie-ins
- Hydrotesting and commissioning

Site Assessment

On 1 October 2005, SIGIR performed an on-site assessment of the KIC Crossing project. During the time on-site, the assessment team discussed the project's status and the processes used to manage construction and ensure QC with the USACE Quality Assurance Representative (QAR) and the PIJV QC Manager. The assessment team observed the project's overall progress and status. This assessment covered work completed, work in progress, and work pending. We conducted the assessment during the early stages of construction in order to determine if field work was consistent with contract requirements and whether corrective action would be necessary to provide reasonable assurance of the successful completion of the project's objectives. Site Photo 2 shows the Kirkuk Irrigation Canal near the pipeline crossing.



Site Photo 2: Kirkuk Irrigation Canal

Work completed:

Field work had been accomplished prior to the site visit, although not 100 percent complete; therefore, this work will be addressed in the next section, “Work in progress.”

Work in progress:

Excavation of pipeline trench

The PSSR required excavations of approximately 750 linear meters of trenches for placement of the pipeline. When old pipelines were encountered, temporary pipeline supports were to be constructed, as needed, to ensure the old pipelines did not collapse into the excavation.

During the site visit, the assessment team verified that the excavation of the trenches was progressing. While most of the excavation for the pipeline trench was complete, a few areas required additional excavation to straighten the trench to comply with contract specifications. The trench was estimated to be about 750 m in length and approximately eight to ten feet in depth. Old pipelines were encountered in the pipeline trench, so the excavation was adjusted accordingly. Oil was observed seeping from the ground or leaking from other pipes and accumulating in the pipeline trenches, on the soil, and on top of the standing water. Procedures were implemented by the subcontractor to mitigate the hazards of toxic fumes to the workers and the fire hazard of flammable materials near welding activities. The subcontractor was observed pumping oil out of the excavations at the time of the site visit. Site Photo 3

shows excavation of trenches for placement of the pipeline. Site photo 4 shows excavation of soils in the culvert crossing the KIC. Site photo 5 shows excavations with oil seeps.



Site Photo 3: Pipeline Excavation Work



Site Photo 4: Culvert Over Canal with Soil Removed



Site Photo 5: Common Example of Pipeline Excavation with Oil Seepage

Fabrication of pipelines

The fabrication of the new 40-inch pipeline is relatively uncomplicated. The SOW includes, but is not limited to, the installation of approximately 150 m of 40-inch-0.668-inch WT Grade 60X pipe across the bridge section and approximately 600 m of 40-inch-0.433-inch WT Grade 60X pipe to connect the bridge section to the existing 40-inch line. The existing 40-inch line was previously installed and trenched by the pipeline subcontractor. Radiography testing is required for all welds and all radiographic personnel are to be qualified. The radiography films are to be reviewed by the subcontractor and then validated by the PIJV QC manager.

During the site visit, the assessment team observed that the fabrication of the pipeline was in progress. The subcontractor was fabricating and connecting pipeline sections on both sides of the canal. The fabrication of the bridge section pipeline had not begun at the time of the site visit. The assessment team noted that some of the pipeline had been marked for repair with corrosion control epoxy coating. Radiography testing was not observed during the site visit. Site photo 6 shows pipe sections on site before placement into excavations. Site photo 7 shows a weld connecting two pipeline sections. The fabrication of the pipeline appeared to be consistent with contract and design requirements.



Site Photo 6: Pipe Section on Site before Placement into Excavations.



Site Photo 7: Weld Connecting Two 40-Inch Pipe Sections.

Work pending:

Construction of valve pits

The valve pit locations have been identified at the north and south ends of the bridge. The PSSR stated the subcontractor shall excavate the designated area and install two concrete valve pits in accordance with the issued civil drawings. Two 40-inch valves will be installed in the valve pits and all pipe entry and exit routes will be sealed with cement grout and mastic sealer compound to prevent water or oil seepage into the valve pits. The valve pits will have reinforced concrete sectional slabs roof cover with lifting lugs to enable NOC access. This will form a barrier against unwanted interference, as well as an acceptable roof structure. At the time of the site visit, the construction of the concrete valve pits and the installation of pipelines and tie-ins had not started; therefore, assessment of the construction of the valve pits was not accomplished.

Installation of pipelines and tie-ins

The PSSR required the installation of the pipelines and tie-ins of the new pipelines to the existing pipelines. The installed pipelines' welded joints will be coated, wrapped, and subjected to a Holiday Test witnessed by the PIJV welding inspector. At the time of the site assessment, the pipelines had not been installed or tie-ins completed; therefore, installation of the pipelines and tie-ins were not evaluated.

Hydrotesting and commissioning

The PSSR required hydrotesting and commissioning be performed once the pipeline installation is complete. There are flanges on both ends of the existing 40-inch pipeline. The flanges will be removed and welded on the newly installed pipeline to perform hydrotesting. Following the acceptable hydrotest, the flanges will be removed and the final pipeline butt welds completed. The completed pipeline will be subjected to a hydrotest, as per the PIJV procedures. Upon completion of all hydrotests, the water will be drained and the line blown dry using an air blower. On satisfactory completion and acceptance, the pipe trench will be back filled with washed river sand to a depth of cover of 50 cm over the newly installed pipeline. Backfilling and compacting is required to the surrounding grade and original conditions. At the time of the site assessment, the pipelines had not been installed or tie-ins completed; therefore, hydrotesting and commissioning were not evaluated.

Project Quality Management

The contractor's quality control (CQC) plan and the U.S. Government's QA program were adequate and sufficiently detailed. For example, key procedures to detect, evaluate, correct, and track deficiencies were in-place and effective, such as the radiograph testing of all pipe welds. In addition, the contractor's daily QC reports and the U.S. Government's QAR reports were adequate. Key to the future success of the project will be the continued active engagement of the contractor's QC Manager and the Government's QAR.

During the site visit, the assessment team observed the contractor's QC Manager effectively working with the subcontractor's QC Inspector and other subcontractor supervisors. In one instance, the contractor's QC Manager pointed out welding and pipe cover problems. The message was presented in a positive manner and it appeared that the subcontractor's QC Inspector became more aware of the expected quality level. Site Photo 8 shows a subcontractor's QC inspector, contractor's QC manager and QAR discussing a weld that needs rework.



Site Photo 8: Subcontractor QC Inspector, Contractor's QC Manager, and QAR Discuss a Weld That Needs Rework

In another instance, we observed the contractor's QC Manager discuss a pipe placement problem with subcontractor personnel. Specifically, oil that seeped into the pipeline's excavation presented a fire and safety hazard to welders and construction workers. To ensure safety and quality workmanship, the contractor's QC Manager explained how to place clean sand and a heavy duty plastic material (tarp) in the excavation to form a protective barrier between the oil and workers. Site Photo 9 shows a contractor's QC manager explaining how to place protective liner in the pipeline excavation.



Site Photo 9: Contractor's QC Manager Explains How to Place Protective Liner in the Pipeline Excavation

Project Sustainability and Operational Effectiveness

Sustainability

A review of the contract file and specification submittals, and discussions with PIJV project managers and USACE Project Engineer disclosed that the U.S. Government does not plan to maintain or operate the pipelines and manifolds after commissioning. The pipelines and manifolds will be turned over to the Iraqi Ministry of Oil (MoO) and the NOC after commissioning. As-built drawings of the pipeline and manifold system, a recommended list of spare parts, and standard operating procedures will be provided to the MoO and the NOC upon completion.

Operational Effectiveness

Pipelines are a reliable and cost effective method of transporting large volumes of petroleum. The KIC Crossing project is an important component of the pipeline system that will transport oil from the Kirkuk oil fields to the ITP and refineries.

Conclusions

Based upon the field work performed during this assessment, we reached the following conclusions for assessment objectives 1, 2, 3, 4, and 5. Appendix A provides details pertaining to Scope and Methodology.

1. Determine whether project results will be consistent with original objectives.

The completed project will likely meet and be consistent with original TO objectives to repair and provide continuous pipeline operations between the Kirkuk oil fields and refineries and the ITP crude oil pipeline, if current construction methods are continued. Specifically, the construction and installation of approximately 750 m of 40 inch diameter pipeline across the KIC via an existing concrete culvert bridge and the connection to an existing pipeline on either side of the canal is a critical element of the original TO. As a result, the project should effectively contribute to the repair of the Iraqi oil infrastructure and the re-establishment of continuous pipeline operations.

2. Determine whether project components were adequately designed prior to construction or installation.

The design package was completed and approved prior to construction and appears specific enough to construct the project. The design to construct and install approximately 750 m of 40 inch diameter crude oil pipeline across the KIC via an existing concrete culvert bridge with connection to an existing pipeline on either side of the canal is practical in terms of cost and technical difficulty. As a result, the project should be constructed in accordance with the SOW and significantly contribute to the TO's objective to repair and provide continuous pipeline operations between the Kirkuk oil fields and the Baiji Refinery and the ITP crude oil pipeline.

3. Determine whether construction or rehabilitation met the standards of the design.

The construction of the project will likely meet the standards of the design, with continued active participation of the QA and QC personnel. While on site, we observed the QM team engaged in discussions that yielded agreement and understanding between all parties. Accordingly, the project should effectively link the existing pipelines on either side of the KIC.

4. Determine whether the Contractor's Quality Control plan and the Government quality assurance program were adequate.

The CQC plan and the U.S. Government QA program were adequate. This occurred because the contractor's QC Manager and the U.S. Government's QAR effectively implemented the requirements of a sufficiently detailed CQC plan and QA program. For example, procedures to detect, evaluate, correct, and track deficiencies were in-place and effective. In addition, the contractor's daily QC reports and the U.S. Government QAR reports were adequate. Key to the future success of the project will be the continued active engagement of the contractor's QC Manager and the U.S. Government's QAR. As a result, project construction will likely conform to contract requirements and design specification.

5. Determine if project sustainability and operational effectiveness were addressed.

Sustainability and operational effectiveness were adequately addressed in this project. Specifically, the U.S. Government does not plan to maintain or operate the pipeline after commissioning. The pipeline operations will be turned over to the MoO and the NOC after commissioning. As-built drawings of the pipeline and manifold system, a recommended list of spare parts, and standard operating procedures will be provided to the MoO and the NOC upon completion. In addition, operational effectiveness was adequately addressed. Pipelines are a reliable and cost effective method of transporting large volumes of petroleum. The KIC Crossing project is an important component of the pipeline system for transporting oil between the Kirkuk oil fields, the ITP and refinery facilities.

Recommendations and Management Comments

We provided the results of our assessment to the appropriate Project and Contracting Office and U. S. Army Corps of Engineer officials who concurred with our conclusions. This report does not contain any negative findings. Therefore, management comments were not required.

Appendix A. Scope and Methodology

We performed this project assessment in September and October 2005, in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency. The assessment team included an engineer and an auditor.

In performing this Project Assessment we:

- Reviewed contract documentation, including the Independent Government Estimate, Scope of Work, Contract, and contract modifications;
- Reviewed the design package (drawings and specifications), Quality Assurance Plan, Quality Control Plan, contractor's daily Quality Control reports, and Quality Assurance Representative reports;
- Interviewed the U.S. Army Corps of Engineers Project Engineer, and Quality Assurance Representative, and the contractor's Project Manager, Quality Control Manager and other operational personnel on-site; and
- Conducted an on-site assessment of the Kirkuk Irrigation Canal Crossing and documented results.

Appendix B. Acronyms

CLIN	Contract Line Item Number
CQC	Contractor Quality Control
ITP	Iraq-to-Turkey Pipeline
KIC	Kirkuk Irrigation Canal
M	Meters
MoO	Ministry of Oil
NOC	Northern Oil Company
PIJV	Parsons Iraq Joint Venture
PCO	Project and Contracting Office
PSSR	Project Scope and Status Report
QA	Quality Assurance
QAR	Quality Assurance Representative
QC	Quality Control
QM	Quality Management
SIGIR	Special Inspector General for Iraq Reconstruction
SOW	Statement of Work
TO	Task Order
USACE	U.S. Army Corps of Engineers
WT	Wall Thickness

Appendix C. Project Assessment Team Members

The Office of the Assistant Inspector General for Inspections, Office of the Special Inspector General for Iraq Reconstruction, prepared this report. The principal staff members who contributed to the report were:

Randall Nida

Lloyd Wilson